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Atraumatic Method of Intraoperative Retrograde Transhepatic Biliary Stent Insertion

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A significant risk of hepatic injury remains using reported methods of intraoperative retrograde transhepatic stenting (IRTS). Our hypothesis was that we could minimize this risk by: (1) using a pliable sheath to create a stent tract that follows the curve of the biliary tree, (2) decreasing the stent diameter, and (3) avoiding the hepatic hilum. We evaluated the safety of a novel technique of intraoperative stenting employing these three concepts. Twenty-four patients underwent IRTS between 1992 and 1995 at our institution after potentially curative resection (one bypass). Malignant disease was present in 22 of 24 patients. Bile ducts were normal caliber in all patients. There was no operative mortality and 38% operative morbidity, all readily treated. All complications were due to stent dislodgment. There were no deaths. This novel atraumatic method of IRTS has acceptable morbidity and mortality. Complications due to stent insertion are minimal. The technique compares favorably with previous methods of IRTS and offers a viable alternative to the surgeon when a transhepatic stent is required. Anchoring the stent securely to the skin is essential to prevent catheter dislodgement.

KEY WORDS: **biliary stents, intraoperative, transhepatic, retrograde**

INTRODUCTION

Intraoperative transhepatic stenting of a biliary-enteric anastomosis is often desired to provide adequate biliary decompression. Insertion of a large instrument can result in injury to the liver, blood vessels, or bile duct. Minimizing the risk of stent insertion generally requires that one traverse a minimum of liver parenchyma after exiting (intraoperative retrograde method) or before entering (percutaneous method) a bile duct. The way to do this is to traverse a peripheral bile duct (Fig. 1A), avoiding the liver hilum (unlike what was done in Fig. 1B), where the large hepatic vessels are located. Unfortunately, although a number of operative techniques [1,2] result in a functional transhepatic stent, they are often associated with complications, which usually result from the large size of the instrument creating the transhepatic channel and/or the inability of the surgeon to guide the instrument accurately through a very peripheral bile duct and out of the liver, avoiding the hilum.

In an attempt to minimize the risk of complications, we have developed a novel method of intraoperative biliary stent insertion using a fine metal sheath. The purpose of this study was to evaluate the success of the technique.

MATERIALS AND METHODS

Patients

Twenty-four patients underwent intraoperative transhepatic biliary stent insertion at our institution between 1992 and 1995. Stents were routinely placed in resected patients. A 3.2 French Sacks metal sheath (Medi-tech, Watertown, MA) and an 8.5 French VTCB polyurethane biliary catheter (Medi-tech) were used. Thirteen males and 11 females were stented. All patients except two had malignant disease (Table I). All patients presented with normal caliber, unobstructed bile ducts. Two patients had

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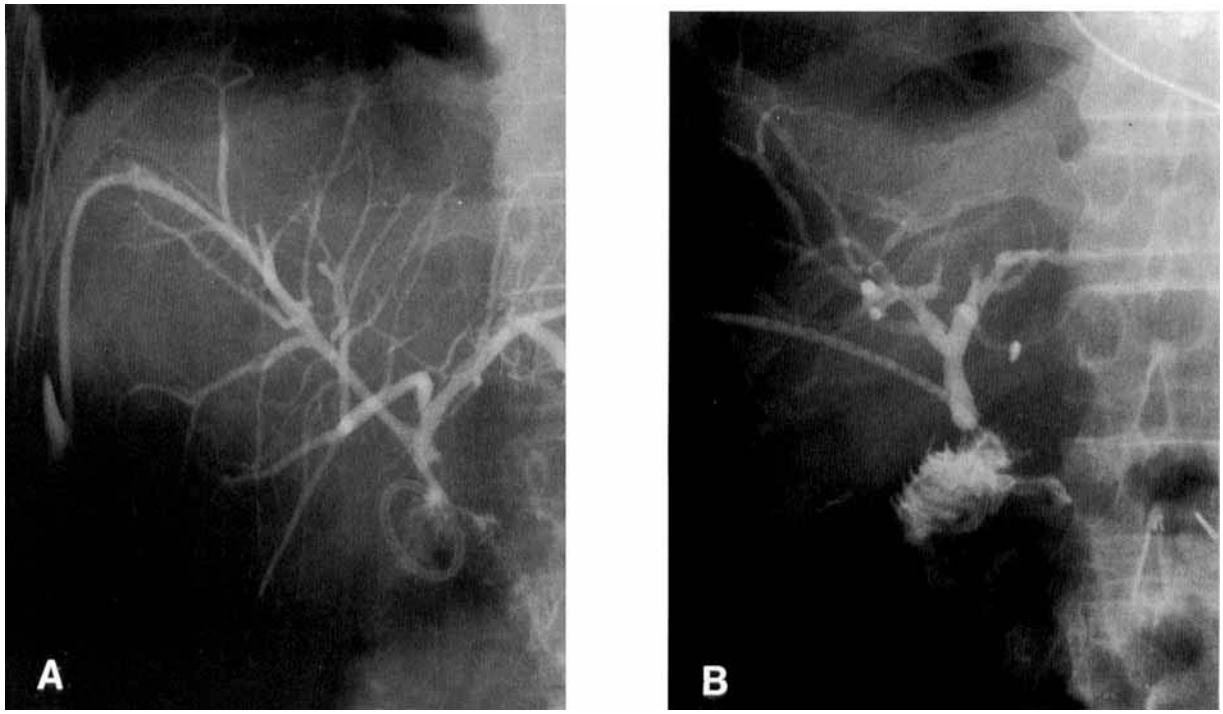

Fig. 1. **(A)** Transhepatic biliary stent exiting the liver through a peripheral bile duct. **(B)** Transhepatic biliary stent entering a central bile duct near the liver hilum.

TABLE I. Characteristics of Patients Who Had Undergone Intraoperative Placement of Transhepatic Stents

Patients	24
male	13
female	11
Stents	26
right	24
left	2
Diagnosis	
Carcinoma	
pancreas	18
bile duct	4
Benign stricture	2

two stents placed. Four of 26 stents were inserted through a divided left hepatic duct, whereas the remaining 22 entered the common hepatic duct and traversed the right hepatic duct. Stents were removed 3 weeks to 6 months (median 2 months) after surgery.

Technique

After transection of the bile duct and removal of the tumor, the Sacks sheath is bent to negotiate the curve of the bile duct (Fig. 2a). The fine metal sheath (Fig. 2b) was carefully guided through the liver capsule with the operator palpating the sheath tip on the liver surface using his or her other hand. A 14-gauge angiocath is advanced percutaneously through the abdominal wall at a site selected for the catheter to exit. A flexible wire is threaded through the sheath and the angiocath. After dilatation of the tract, the biliary catheter is threaded over the wire (Fig. 2c). The catheter is positioned in the small bowel, the Cope loop (a silastic catheter with an adjustable loop at the end) on the catheter tightened, and the anastomosis completed. The catheter is secured to the skin with suture at the exit site (Fig. 2d).

RESULTS

Dislodgment of the transhepatic stent occurred in 9 of 24 patients (38%), resulting in cholangitis in 7 and bleeding in 2 patients. These complications were readily treated with stent repositioning, with or without intravenous antibiotics. There was no early or late stent related mortality.

DISCUSSION

Transhepatic stenting of the biliary system is done for a variety of reasons, including palliative treatment of benign or malignant obstruction and for decompressing a biliary-enteric anastomosis. We discuss our results of intraoperative retrograde stent insertion in a group of patients who were felt to require anastomotic stenting after resectional or bypass surgery.

In 1980, Starzl [3] described a "simplified" method of stent insertion to palliate patients with obstructed hepatic ducts. To reduce the trauma involved with conventional

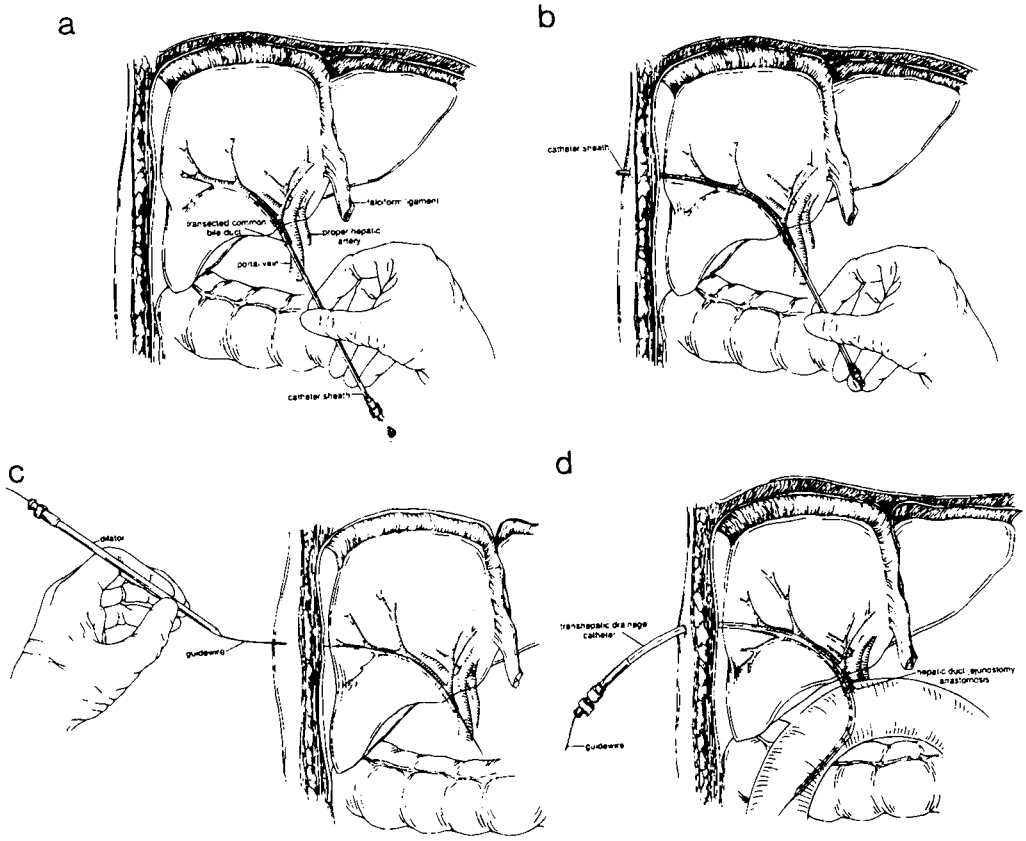

Fig. 2. **(a)** Metal sheath inserted through divided hepatic duct into the right biliary tree. **(b)** Sheath advanced through liver and abdominal wall. **(c)** Guidewire advanced through sheath. Dilator advanced over guidewire through abdominal wall into liver capsule. **(d)** Dilator removed, biliary drainage catheter inserted over guidewire through biliary tree and anastomosis into jejunum. Drainage catheter secured to skin with suture.

methods of intraoperative stent insertion, he advocated relieving the obstruction with a Bakes dilator just sufficient to identify the proximal duct. A Council stylet, a commonly used urologic instrument, was then passed as far as possible up the appropriate duct and penetrated the proximal duct, liver parenchyma, and Glisson's capsule. The newly formed tract was dilated with a filiform and follower, and a silicone catheter was pulled through the opened tract.

Rossotto [4] described the use of a music wire, with two fused, olive-shape copper edges, to insert a stent through a dilated biliary tree.

A technique for passing a J wire through an opened distal bile duct and past an obstructing lesion has been described by Silk [5]. The wire is gently guided through the peripheral biliary radicals and the liver capsule. The tract is dilated with a stiff rubber catheter and the catheter pushed through the liver surface. A silicone stent is then tied to the rubber catheter and gently pulled through the liver past the obstruction.

All of these methods address the management of patients with obstructed biliary trees and dilated bile ducts. Less is published on intraoperative stent insertion in patients with unobstructed, normal caliber bile ducts, such as our patients. In stenting a biliary-enteric anastomosis, options included transhepatic and transjejunal stenting. With transhepatic stenting, major risks include hemobilia, biliary fistula, subhepatic abscess, cholangitis, and bleeding. The first three mentioned risks occur infrequently [6–8]. Cholangitis secondary to an obstructed tube is readily treated with antibiotics and stent change and minimized with routine irrigation and stent changing. Bleeding frequency and volume are related to the trauma of the procedure, as well as the placement of the transhepatic catheter relative to the liver hilum, where large blood vessels are concentrated. An example of what can occur if the liver hilum is not avoided is illustrated in Figure 3A,B. This patient had a stent inserted percutaneously entering the right hepatic duct near the liver hilum (Fig. 3A). He developed an arterial bleed and subsequent pseudoaneurysm (Fig. 3B), which required embolization.

Transjejunal tubes are advocated by many, including Blumgart [9]. A modification of the transjejunal tube allows subsequent radiologic or choledochoscopic access

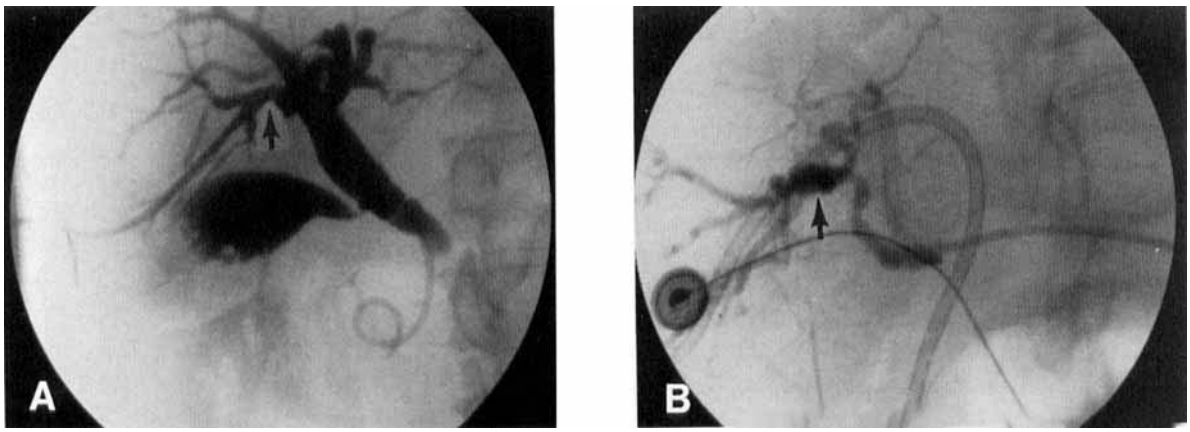

Fig. 3. (A) Transhepatic biliary stent entering the right hepatic duct near the liver hilum (arrow). (B) Pseudoaneurysm (arrow) resulting from trauma to an intraparenchymal vessel during transhepatic biliary stent insertion.

to the anastomosis through the creation of a choledocho-jejunocutaneous fistula, or so-called Hutson-Russell loop [10], or through bringing up subcutaneously the end of the Roux-en-Y loop of jejunum used for the biliary-enteric anastomosis [9]. The major problem with these stents is the relatively high rate of tube dislodgment and the difficulty in replacing such a displaced tube through a strictured anastomosis in a patient with cholangitis or obstruction.

All of our operative patients had unobstructed, small caliber bile ducts, mostly because of previous surgical bypasses. Postoperative stents were therefore indicated to decompress the biliary tree until anastomotic edema subsided, to provide access for cholangiography, and to insure patency of the anastomosis. By using a fine, pliable sheath to create a stent tract, we were generally able to get within one centimeter of the liver capsule before advancing the sheath to traverse the remaining liver parenchyma. We had no procedure-related complications.

We have found only a few reports [11–13] that discuss long-term follow-up of patients with intraoperatively placed transhepatic stents (Table II). In 1989, Cameron and colleages [11], who have extensive experience with transhepatic stent insertion, reported on 25 patients with benign postoperative biliary strictures who underwent preoperative percutaneous Ring catheter insertion followed by intraoperative silastic linear stent insertion using the Ring catheter tract. It is likely that the already created tract facilitates stent insertion and minimizes complications. Munoz [12] reported on 45 patients with postoperative biliary strictures who underwent surgical reconstruction and transhepatic T tube insertion at his institution. A 12-year experience with silastic U tubes at Rush-Presbyterian-St. Luke's Medical Center involving 54 patients with biliary obstruction, nine of whom underwent potentially curative surgery for malignant disease, was reported in 1993 [13]. Comparing these series is difficult because of the different disease process, the different stents used, and methods of stent insertion, etc. Nonetheless, based on Cameron's results, we also employed a linear catheter, but attempted to use a catheter of smaller diameter. Our results compare favorably with those presented in Table II, although stent dislodgment, the cause of each complication, remains a problem.

TABLE II. Complications After Potentially Curative Surgery With Intraoperative Placement of Transhepatic Stents

	Cameron 1989 [11]	Munoz 1990 [12]	Millikan 1993 [13]	Present study 1995
Disease (patients)				
Benign	25	45	0	2
Malignant	0	0	9	22
Stent type	16–18F Linear	?F T shape	?F U shape	8.5F Linear
Operative complications (%)[a]				
Mortality	0	13	0	0
Morbidity	20	8	55	38
Bleeding	4	0	33	8
Pancreatitis	4	0	0	0
Cholangitis	8	8	33	29
Subphrenic abscess	4	0	11	0
Late complications (%)				
Mortality	0	2	N/A	0
Morbidity	N/A	18	22	0

[a]Mortality unrelated to the operative procedure is not included. Some patients developed more than one complication.
N/A = not available.

The fact that in our series all of the significant morbidity from stent insertion was due to stent distraction underscores the importance of maintaining the side holes within the bile duct and small bowel by tightly securing the catheter to the abdominal wall. Prior to discharge, all of our patients have their biliary catheters secured snugly in place with a 10×10 cm Stomahesive patch, which is

placed over a Molnar disc. Since there is no tumor shoulder in the operative group to which the Cope loop can attach, these stents cannot be expected to be held in place by the curved tip alone.

In summary, we present a novel method of intraoperative transhepatic stent insertion using a small diameter metal sheath to exit the bile duct and liver substance away from the liver hilum, followed by percutaneous insertion of a polyurethane biliary drainage catheter. This technique results in acceptable morbidity that compares favorably with presently available techniques of intraoperative transhepatic stent insertion and represents a viable alternative for surgeons who must place a transhepatic stent.

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